

form of magnetic separation was coming to the front. For a long time the method was confined to minerals that were naturally or artificially magnetic in the everyday acceptance of that word, that is to say, were capable of being attracted by an ordinary horse-shoe magnet. Faraday had discovered so far back as 1845 that numerous bodies, not magnetic in this ordinary sense, were nevertheless affected by powerful magnetic fields, but it was not until 1896 that this principle was applied to the separation of minerals by J. P. Wetherill; he succeeded in separating a series of minerals, all very feebly magnetic, from the somewhat more feebly magnetic zinc oxide and other zinc ores of New Jersey by the use of very powerful magnetic fields, produced by means of electromagnets with wedge-shaped pole-pieces, and since his original invention this principle (the magnetic separation of non-magnetic material, as it is sometimes called) has found an extended application, one of the most recent being the magnetic concentration of specular hematite by the Edison deflection method, using pole-pieces of the Wetherill type. Such separations as that of wolfram from tinstone, of raw spathic ore from zinc blende, of garnets from silver ore, which are necessary before any rational metallurgical treatment of the ores is possible, but which offer insuperable difficulties to the ordinary methods of dressing, have been rendered possible by the adoption of the Wetherill principle, and I see no reason to doubt but that it will find still more extended application in the future. I may point out that no successful wet separator for feebly magnetic minerals has yet been devised; this is a problem presenting numerous difficulties, but probably quite capable of solution, and at the same time very well worth solving.

Magnetic separation, though so comparatively novel, has already been extensively applied, the largest installations being naturally those for the treatment of iron ores. At the present moment the output of high-grade magnetite concentrate, produced by this process, in Sweden cannot fall far short of half a million tons per annum, and in Norway active preparations are in progress for work on a much larger scale at Dunderland, Salangen, Ofoten, and Sydvaranger, from which a yearly output of fully two millions of tons of high-class iron concentrates is expected.

Attempts to utilise other properties of minerals for their separation may be said to belong wholly to the present century. Thus Messrs. Blake and Morscher in 1901, and Mr. Negreanu in 1902, have attempted to use electrostatic methods, depending upon the variations in the electrification of minerals due to their varying electric conductivities; the former of these two methods has been used with success for the dressing of blende in the United States.

Finally, the difference in surface tension has been employed in Elmore's oil separation process, in the various flotation processes, devised since the discovery of the principle by C. V. Potter in 1901, and applied to the very intractable zinc-lead ores of the Broken Hill district of New South Wales, and finally in the Elmore vacuum process. All these processes seem to depend upon the differential adhesive force, with which water, oil, or gas cling to the surface of different minerals. These methods are still in their infancy, and the underlying principles cannot yet be said to be properly understood, but already they promise to be of great value in recovering valuable material from slimes that are not amenable to any other mode of treatment, particularly for treating those intimate mixtures of zinc blende and galena that have for so long defied the ingenuity of both miners and metallurgists. There are grounds for hoping that many of the problems that have hitherto baffled the ore-dresser may be solved by some application of these modern methods.

SCIENCE AND INDUSTRY.

A SERIES of articles has appeared in the *Revue scientifique* (May 18 and July 13, 1907; February 22, 1908) comparing the teaching of technical chemistry in France with the instruction given in the same subject in other countries. The last article is of special interest as presenting a French view of the relation subsisting between science and industry in our own country. After describing in detail the excellent organisation of scientific education in Germany, Belgium, and Switzerland, and

emphasising the closeness of the union existing in these countries between the manufacturer and the man of science, it is stated that the system of technical education adopted in England presents no feature worthy of commendation.

The English manufacturer fails to realise how much he may profit from the assistance of pure science:—"l'industriel anglais paraît ou veut ignorer le chimiste de carrière qui vient à lui avec un bagage scientifique; son but étant de produire 'beaucoup et à bon marché' il lui suffit quand il remarque un ouvrier plus intelligent et plus perfectible que ses camarades de l'envoyer aux écoles du soir, prendre un semblant d'instruction théorique et cela sur la seule partie de la chimie qui peut intéresser son métier." The many technical colleges under the control of municipal authorities in this country do not aim at producing highly trained "chemists" in the scientific sense of the word, but waste their resources in providing evening classes for workmen and artisans, and in imparting the rudiments of science to boys from the primary schools.

The university colleges, on the other hand, with the exception of the Central Technical College, provide only a training in pure chemistry. Until science and industry become more intimately united in this country it is predicted that the technical schools will go on producing merely good workmen and the universities men who are unable to investigate practical problems or apply discoveries made in the laboratory on an industrial scale.

It would appear that the chemist is as little appreciated in France as in our own country, and it is pertinently asked whether this is not due to his lack of "general culture" which prevents him from acquiring the broad ideas necessary for the initiation or development of important enterprises. The same question no doubt may be asked of the chemists in this country, but whatever be the answer there is no doubt that, for the proper development of our industry in the near future, a closer union between the industrialist and the chemist is vitally necessary.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The board of managers of the Arnold Gerstenberg studentship gives notice that a studentship will be offered for competition in the Michaelmas term of 1909. The competition will be open to men and women who have obtained honours in part i. or part ii. of the natural sciences tripos, and whose first term of residence was not earlier than the Michaelmas term of 1903. The studentship, which will be of the annual value of nearly 90*l.*, will be tenable for two years.

The Linacre lecture will be delivered by Dr. W. Osler, F.R.S., on Wednesday, May 6, in the lecture-room of anatomy and physiology, New Museums. The subject of the lecture will be "Thomas Linacre, his Life and Works."

It is proposed to grant the use of the Senate House on May 15 for a meeting of the members of the University to be addressed by Mr. Haldane, Secretary of State for War, in the explanation of his scheme in connection with the training of officers for war.

Part i. of the natural sciences tripos will commence on Monday, May 25, and part ii. on Wednesday, May 27. The number of entries for the two parts is about two hundred and twenty.

GLASGOW.—Among the recipients of the honorary degree of Doctor of Laws on Commemoration Day, April 22, were several distinguished by their scientific attainments. In the afternoon a portrait of Prof. M'Kendrick was presented to the University, with the sum of 450*l.* for the equipment of a laboratory of experimental psychology in the new physiological buildings, in honour of Prof. M'Kendrick's thirty years' service to the University as professor of physiology. In presenting the representatives of science for the degrees, Prof. Gloag, dean of the faculty of law, made the following references to their work:—

MR. G. T. BELLBY, F.R.S., chairman of the governors of the Glasgow and West of Scotland Technical College.—The present head of the Glasgow and West of Scotland Technical College, who is a Fellow of the Royal Society,

has done much for the advancement of chemical science and of its applications to industry. He was president of the Society of Chemical Industry in 1899, and of the chemical section of the British Association at its meeting in South Africa in 1905. He was also vice-president of the Institute of Chemistry from 1903 to 1906. He is the inventor of novel processes which have created or transformed important departments of scientific production; he has devoted himself to the improvement of technological training in relation to our native industries, and he has contributed many researches of value to the memoirs of learned societies at home and abroad. The Senate, in presenting Mr. Beilby for the degree of Doctor of Laws, recognise the value alike of his scientific work and of his services to an educational institution so closely connected with the University and with the City of Glasgow.

COLONEL DAVID BRUCE, C.B., F.R.S., Royal Army Medical Corps.—A graduate of Edinburgh University, Colonel Bruce has had a distinguished career in the Royal Army Medical Corps, and rendered eminent services to the nation in the Egyptian and South African campaigns. But his services have been not only to his country, but to humanity. To his discovery, at great personal risk, and by untiring labour, of the microbe which forms the inducing cause of Malta fever, and to the researches to which that discovery led, the naval and military population of Malta owe their present immunity from a disease which has been the bane of the island for centuries. Similar work in Africa has resulted in extending our knowledge of the causes which produce the dreaded tsetse-fly disease of South Africa, and the epidemic sleeping sickness of Uganda. Work of this kind, requiring all the courage of the soldier, all the patience and acumen of the man of science, renders him amply entitled to any honour which a university can bestow.

DR. J. J. DOBBIE, F.R.S., director of the Royal Scottish Museum.—In Dr. Dobbie the Senate proposes to honour a distinguished son of this University. Dr. Dobbie completed a successful career as a student by graduating with first-class honours in natural science, and obtaining the George A. Clark scholarship. After further studies in Germany and in the University of Edinburgh, he obtained the degree of Doctor of Science in that University. He acted as lecturer in mineralogy, and as assistant to the professor of chemistry in Glasgow, until his appointment as professor of chemistry in the University College of North Wales at Bangor. After holding that office for nineteen years, he was appointed to the important post he now holds—the directorship of the Royal Scottish Museum. During a life thus filled with important educational work, he has found time to make contributions of great value to scientific literature, in recognition of which the Royal Society of London has admitted him to the honour of its fellowship.

MR. ROBERT KIDSTON, F.R.S.—Mr. Kidston has devoted much time and study to an important department of the science of geology, and is recognised as one of the leading authorities on palaeophytology. A series of more than eighty papers, published under the auspices of the Royal Societies of London and Edinburgh, attest his knowledge of the Carboniferous flora. He has arranged and catalogued the collection of Palaeozoic plants in the British Museum. His mastery of the subject, and his generous readiness to expend his labour for the advancement of science, have been taken advantage of by other countries than his own. He has been engaged in a catalogue of the fossil plants in the Royal Museum at Brussels, and has received an invitation to undertake similar work at Stockholm. The fossil remains, now being discovered in the recently opened coalfields of Holland, are being submitted for his determination. In presenting Mr. Kidston for this degree, the Senate of the University of his native city wish to express their appreciation of his manifold services to geological and botanical science.

DR. J. C. M'VAIL, medical officer of health for the counties of Stirling and Dumbarton.—A graduate of the University of St. Andrews, and a former examiner in medical jurisprudence and public health in this University, Dr. M'Vail holds the highest position in that important department of modern civil administration—the care of public health. For eighteen years county medical officer

of health for Stirling and Dumbarton, he has been president of the Incorporated Society of Medical Officers of Health of Great Britain, of the Incorporated Sanitary Association of Great Britain, and of the Glasgow and West of Scotland Branch of the British Medical Association. In 1906 he delivered with acceptance the Lane lectures in Cooper Medical College, San Francisco, and the following year acted as medical investigator to the Royal Commission on the Poor Law. His published works, dealing with broad questions of State medicine and sanitary science, are recognised as authoritative in these important subjects.

THERE will be a reception at Bedford College for Women (University of London) on "Commemoration Day," Wednesday, May 6, after the presentation of graduates at the University of London.

AN article by Mr. J. A. Venn in the issue for the Lent term of the *Oxford and Cambridge Review* deals with the number of matriculations at Oxford and Cambridge, respectively, from 1544 to 1906. The article is accompanied by a graph, in which the number of matriculations—calculated on an average of five years about any given year from 1540 to 1907—and the years are plotted. The essay shows how the history of England has been reflected with clearness on university life, as evidenced by the varying numbers of students who came to pursue their studies at Oxford and Cambridge. The graph reveals two striking features:—first, both universities were in the first quarter of the seventeenth century as large as they were destined to be until 1850; secondly, the way in which the curves for the two universities keep repeating each other's movements at exactly the same dates, in most instances, and very frequently to exactly the same extent, showing that similar influences were affecting both universities throughout different centuries. Readers must be referred to Mr. Venn's article for detailed comparisons, but an example of the kind of interesting information which may be gleaned from the article may be given:—in 1630 one out of every 3600 of the male population of England and Wales proceeded to either Oxford or Cambridge, but in 1700 the figures were one in 5600. These figures continued to get steadily worse until 1801, when they read one in 11,400, but at the present day they stand at one in 9000.

THE Board of Education has issued (Cd. 4038) regulations for the preliminary education of elementary-school teachers in England, which will come into force from August 1 next. The new regulations contain various alterations, and among these, as being of special importance, may be mentioned that by which it will no longer be required that candidates for pupil teachership shall pass an examination test qualifying them for recognition by the Board as pupil teachers. A prefatory memorandum to the regulations points out that, since all pupil teachers must pass a leaving examination, which usually falls between the ages of seventeen and eighteen, it does not appear to the Board desirable, upon educational grounds, that they should also be called upon to pass an examination between the ages of fifteen and sixteen, except in so far as such examination may form part of the ordinary arrangements of the school at which they are being educated, or may be necessary in order to facilitate the proper selection of candidates. It is also satisfactory to find a recognition of the principle that the teacher should take a prominent part in any process of selection of suitable candidates. The Board hopes that, in view of the annually increasing proportion of candidates for pupil teachership who have received their preliminary education in secondary schools, it may be found possible, henceforward, for education authorities to base the selection and approval of candidates upon the advice of the teachers of the candidates rather than upon the results of an examination.

By the will of the late Dr. H. C. Sorby, F.R.S., several substantial gifts are made for scientific purposes. The Sheffield Art Gallery and Museum will receive Dr. Sorby's large series of animals and marine alga, mounted as lantern-slides, and forming a continuous series illustrating the natural history of Kent, Essex, and Suffolk. Among

other bequests to the University of Sheffield are:—(a) Such of his books not bequeathed to the Literary and Philosophical Society as the University shall select; (b) optical and scientific instruments and apparatus; (c) cabinets and cases of geological and mineralogical specimens and preparations not bequeathed to the citizens of Sheffield; (d) manuscript books and notes upon geological and other scientific subjects; (e) lantern-slides similar to those bequeathed to the citizens of Sheffield, and the whole of his large collection of lantern-slides illustrating many scientific and other subjects; (f) microscopical objects of rocks, minerals and metals, and other things of a like nature. A legacy of 6500*l.* is bequeathed to the University, and the University is desired to appropriate out of other funds 3500*l.*, the amount of a gift which Dr. Sorby made to the University College of Sheffield in 1903, making together 10,000*l.*, as an endowment for a professorship of geology or such other subject as the University may think more suitable. This legacy is charged upon the funds to be appropriated to answer certain annuities given by the will and payable as and when the annuities fall in. To the Royal Society of London is bequeathed the sum of 15,000*l.*, the income therefrom to be devoted to the establishment of a fellowship or professorship for the carrying on of original scientific research. The object is to promote the discovery of new facts rather than the teaching of what is known. It is suggested that when possible the research shall be carried out in one of the laboratories of the University of Sheffield. This condition may, however, be dispensed with when the nature of the investigation requires that the work should be done elsewhere. So long as in the opinion of the council of the Royal Society the University of Sheffield is not efficiently equipped in laboratories and appliances, then the income shall be administered in such manner as the said council shall think best for the promotion of original research. Other legacies are:—the Literary and Philosophical Society of Sheffield, 500*l.*, and the Geological Society of London, 1000*l.*

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 27.—"The Influence of Temperature on Phagocytosis." By J. C. G. **Ledingham**. Communicated by Dr. C. J. Martin, F.R.S.

(1) When serum, cocci, and leucocytes are mixed directly and incubated at different temperatures, the number of cocci taken up increases more or less regularly with the temperature. By this method it has been shown that the phagocytic intake at 18° C. is only about one-fourth to one-fifth of that at 37° C.

(2) This fall, at least within the temperature range 37° C. to 18° C., is due to the diminished rate of combination of the serum with the coccus as the temperature falls.

(3) When cocci which have previously been exposed to the action of serum, either at 37° C. or at 18° C., are put in contact with leucocytes, the intake is practically the same, whether the phagocytosis takes place at 37° C. or at 18° C. The number taken up, however, after combination at 18° C., and more especially at 7° C., falls very short of the number taken up after combination at 37° C.

(4) Experimental results, detailed above, lead one to assume that prolonged contact of a serum with cocci at a low temperature (18° C. or 7° C.) leads to a maximum absorption of opsonin by the cocci (corresponding to that temperature), so that the subsequent phagocytosis is identical whether it takes place at 37° C. or at 18° C.

(5) Provided that cocci loaded with opsonin up to a certain maximum are presented to the leucocyte, the phagocytic energy of the latter is independent of the temperature within a wide range.

(6) From the appearances on stained films, it would seem that sensitised micro-organisms exposed to the action of leucocytes at very low temperatures tend to congregate near the periphery of the leucocytes, although little or no phagocytosis may take place. Hence, within a suitable temperature range, it may be presumed that the inclusion

of sensitised micro-organisms by the leucocyte is a surface-tension effect taking place between the coccus and the protoplasmic wall, amoeboid energy playing only a subordinate part in the process.

MANCHESTER.

Literary and Philosophical Society, March 24.—Prof. H. B. Dixon, F.R.S., president, in the chair.—An annotated list of the alien plants of the Warrington district: G. A. **Dunlop**. One hundred and seventy-five species, comprising with others several of *Papaver*, *Senecio*, and *Sisymbrium*, were enumerated in the paper. Thirty of these are now extinct.—Field notes on the birds of the Ravenglass gully, 1906: C. **Oldham**. The author describes in his paper the habits, during the breeding season, of the black-headed gull, common, lesser, and Sandwich terns, as observed by him at Ravenglass, on the Cumberland coast. The term "gully" he applies to that portion of the sandhills which is occupied by colonies of these birds. He also mentions other species—such as the oyster-catcher and sheld-duck—which nest in or in the immediate vicinity of the "gully."

PARIS.

Academy of Sciences, April 21.—M. H. Becquerel in the chair.—An addition to the demonstration of the mechanism of monocular stereoscopy: A. **Chauveau**.—Concerning *Trypanosoma congolense*: A. **Laveran**. A goat, inoculated with *T. congolense* on November 15, 1906, was cured in July, 1907, from the infection produced by this trypanosome. Re-inoculated with the same organism on August 22, it was infected again, but the second infection was slight, and the animal was cured at the beginning of the following November. Two fresh inoculations, made December 20, 1907, and February 6, 1908, produced no re-infection; the goat had acquired immunity for *T. congolense*. Further inoculation of the same animal with *T. dimorphon*, made on April 1, 1908, produced a well-characterised infection, tending to prove that *T. congolense* constitutes a distinct species from *T. dimorphon*.—A new French observatory: Robert **Jonckheere**. This is the Hem Observatory, situated 8200 metres north-east of the fortifications of Lille. Astronomical observations will be commenced before the end of the year.—The influence of the silent discharge on the isolation resistance of insulators: F. **Nègre**. The resistance of the insulators studied was found to be constant up to a certain critical tension. The latter depends on the dimensions, form, and condition of the surface of the insulator, the resistance falling rapidly as soon as the silent discharge appears over the surface.—The flame spectra of iron: G. A. **Hem-salech** and C. **de Watteville**. The metal is obtained in a fine state of division by passing one of the gases supplying the burner over two electrodes of the metal, either an arc or sparks passing between the latter. The spectra obtained depended on the nature of the flame; thus with coal-gas and air in the region between λ 2250 and λ 5000 750 lines were obtained, with coal-gas and oxygen 250, and with hydrogen and oxygen 210.—The reducing power of the ferropyrrophosphates: P. **Pascal**. Clear solutions of ferropyrrophosphate of soda in water, together with a small amount of sodium pyrophosphate, reduce gold and silver, but not platinum salts. Salts of mercury and copper are also reduced, and there is a strong tendency to the production of highly coloured stable colloidal solutions of the metals.—Combustion without flame, and its application to lighting with incandescent mantles: Jean **Meunier**. The author holds that the temperature of the mantle is much higher than that of the flame surrounding it, and attributes this to the fact that each particle of oxide becomes the focus of an intense local combustion. The combustion by incandescence lowers considerably the inferior limit of inflammability of a gas mixture.—A demonstration of Gibb's phase rule: J. A. **Muller**.—Remarks on a wire-drawing machine of the seventeenth century: Ch. **Fremont**.—The progress of modern surgery judged by the statistics of operations on the knee (resections): M. **Lucas-Championnière**. For this particular operation the mortality has been lowered from 36 per cent. or higher to less than 1 per cent. by the